This is the Pre-Published Version.
This is a pre-copyedited, author-produced version of an article accepted for publication in Physical Therapy following peer review. The version of record P Kannan, S J Winser, B Fung, G Cheing, Effectiveness of Pelvic Floor Muscle Training Alone and in Combination With Biofeedback, Electrical Stimulation, or Both Compared to Control for Urinary Incontinence in Men Following Prostatectomy: Systematic Review and Meta-Analysis, Physical Therapy, Volume 98, Issue 11, November 2018, Pages 932–945 is available online at: https://doi.org/10.1093/ptj/pzy101.

Title: Effectiveness of Pelvic Floor Muscle Training Alone and in Combination With Biofeedback, Electrical Stimulation, or Both Compared to Control for Urinary Incontinence in Men Following Prostatectomy: A Systematic Review and Meta-Analysis

Running Head: Physical Therapy for Prostatectomy

Section/TOC Category: Musculoskeletal

Article Type: Review

Author Byline: Priya Kannan, Stanley J. Winser, Brigitte Fung, Gladys Cheing

Author Information:

P. Kannan, PhD, MPhty, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong. Address all correspondence to Dr Kannan at: priya.kannan@polyu.edu.hk.

S.J. Winser, PhD, MPT, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University.

B. Fung, MSc, BScPT, Physiotherapy Unit, Kwong Wah Hospital, Yau Ma Tei, Hong Kong.

G. Cheing, PhD, MSc, BScPT, PDPT, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University.

Keywords: Biofeedback, Electric Stimulation Therapy, Pelvic Floor, Prostatectomy, Urinary Incontinence

Accepted: May 1, 2018

Submitted: January 10, 2018

Background. The efficacy of pelvic floor muscle training (PFMT) alone and in combination with biofeedback (BFB), electrical stimulation (ES), or both for urinary incontinence in men following prostatectomy is inconclusive.

Purpose. The purpose of this study was to determine whether PFMT works well alone or in combination with BFB, ES, or both in comparison with a control.

Data Sources. The databases Ovid Medline, EMBASE, CENTRAL, Scopus, and Web of Science and the specialized register of the Cochrane Incontinence Review Group were searched from study inception to August 2017. Abstract proceedings from urological meetings, including the European Association of Urology and the American Urological Association, were also searched.

Study Selection. Randomized controlled trials that compared PFMT with ES (anal, stimulation with surface electrodes), BFB, or both and no treatment, placebo, or sham were included in the review. Randomized trials comparing PFMT alone and PFMT plus BFB, ES, or both against a control for urinary incontinence following prostatectomy were also included.

Data Extraction, Synthesis, and Quality. Two independent reviewers completed data extraction and quality appraisal. The Grading of Recommendations, Assessment, Development, and Evaluation tool was used for quality appraisal. Meta-analysis was done with software used for preparing and maintaining Cochrane reviews.

Limitations. Methodological flaws in the included studies limited internal validity.

Conclusions. PFMT alone, PFMT plus BFB and ES, and PFMT plus ES were more effective than the control for urinary incontinence following prostatectomy. The effect of PFMT plus BFB on postprostatectomy incontinence remains uncertain.

Keywords: Biofeedback; Electric stimulation therapy; Pelvic floor; Prostatectomy; Urinary incontinence

Prostate cancer is reported to be the second most frequently diagnosed cancer worldwide.[1] Treatments for prostate cancer are based on the stage of cancer; stage 1 prostate cancer is primarily treated by radical prostatectomy or transurethral resection of the prostate. One of the most frequent complications of radical prostatectomy is urinary incontinence,[2] whereas it is less common following transurethral resection of the prostate.[3] The prevalence rates of urinary incontinence following prostatectomy ranges from 2% to 60%.[3] Urinary incontinence following radical prostatectomy is postulated to be related to insufficiency of the urethral sphincter due to sphincter injuries during surgery or overactivity of the detrusor muscle.[4] Postoperatively, urinary incontinence improves over time and declines or plateaus within 1 to 2 years. However, some men remain incontinent for several years after surgery.[3,5] Conservative management of postprostatectomy incontinence includes pelvic floor muscle training (PFMT), biofeedback (BFB), electrical stimulation (ES) using surface electrodes, anal stimulation, transcutaneous electrical nerve stimulation, and extracorporeal magnetic stimulation either singly or in combination.[3]

PFMT is the first-line treatment for urinary incontinence in men following radical prostatectomy.[4] PFMT consists of intermittent isolated voluntary contractions of the urethral sphincter muscle.[6] Although the number of repetitions and duration of contraction are not standardized, it is generally thought that PFMT must be performed multiple times each day for several months to produce an effect.[6] BFB is used in addition to PFMT in the case of an inability to generate urethral sphincter contraction.[6] ES to spinal cord or nerves controlling the lower urinary tract is applied for men with incontinence to induce bladder or sphincter contraction.[7] ES of the pudendal nerve is thought to activate the pelvic floor muscles to improve urethral closure.[6]

The effectiveness of PFMT for urinary incontinence in women is well established in the literature.[8,9] However, the efficacy of conservative treatments including PFMT, BFB, and ES for urinary incontinence in men following prostatectomy is inconclusive due to insufficient and low quality of evidence.[3,4,10] Whether PFMT works well alone or in conjunction with BFB, ES, or both compared to control (no treatment, placebo, or sham) is not known. Previous reviews have pooled either all controls or all active treatments together in a meta-analysis. The recent Cochrane review of conservative therapies for urinary incontinence following prostatectomy pooled all studies of active treatments (PFMT with or without BFB, electric or magnetic energy) against controls.[3] The systematic review by MacDonald et al evaluated the effectiveness of active interventions such as PFMT, BFB, and ES separately but all controls were pooled together.[4] The effectiveness of PFMT alone compared to control and PFMT combined with BFB, ES, or both compared to control is therefore not known. The objective of this systematic review is to evaluate the effectiveness of PFMT alone and PFMT in combination with BFB, ES, or both compared to no treatment, sham, and placebo for the management of urinary incontinence in men following prostatectomy.

Methods

Data Sources and Searches

Electronic searches of the bibliographic databases were conducted by 1 reviewer (P.K.) from database inception to August 2017. Ovid Medline, EMBASE, CENTRAL, Scopus, Web of Science, the specialized register of the Cochrane Incontinence Review Group, and abstract proceedings from urological meetings (including the European Association of Urology and the

American Urological Association) were searched. Reference lists of included studies and identified reviews were analysed to identify any other potentially relevant articles. Two independent reviewers (P.K. and S.J.W.) conducted study screening and selection. Discrepancies were resolved by discussion between the 2 reviewers. A third reviewer (G.C.) was consulted when required. Search terms entered were either medical subject headings or keywords of 4 major subject areas: prostatectomy; urinary incontinence; pelvic floor muscle training/strengthening; and randomized controlled trials (RCTs). A detailed description of the search terms is presented in supplementary material (eAppendix, available at https://academic.oup.com/ptj).

Study Selection

Study eligibility for the review was defined according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) guidelines.[11] The PICOS (Population, Intervention, Comparison, Outcome, and Study Design) framework was developed and used.[11] RCTs that compared PFMT with ES (anal, stimulation with surface electrodes), BFB, or both and no treatment, placebo, or sham were included in the review. In this review, participants who received only oral instructions, written instructions, or both and no formal PFMT by a trained therapist/nurse were considered to be no-treatment controls. Studies that used at least one of the following outcomes to measure the effectiveness of intervention were included in the review: clinical outcomes important to patients, including 24- or 1-hour pad tests, self-reported recovery of continence, and number of men reporting better continence based on voiding diary or questionnaires. RCTs, pilot RCTs, and randomized cluster and crossover trials, published in English and Chinese languages, were included. Conference abstracts for which full texts were

available were included in the review. Studies on Pilates, PFMT combined with behavioral therapy, and extracorporeal magnetic innervation for urinary incontinence following prostatectomy were excluded from the review. Studies that compared active treatments (for example, BFB to ES; PFMT to BFB, ES, or both) and preoperative to postoperative PFMT were excluded from the review. Quasi-experimental trials were also excluded.

Data Extraction

Data extraction for each included study was done by 2 independent reviewers (P.K. and S.J.W.). The following details were extracted from each included study: first author's name, year and country of publication, participant characteristics (age and sample size), intervention and comparator, and data (mean and SD) reported immediately following intervention (commonly ranged from 1 to 4 months in the included studies) and at the end of the longest follow-up period.

Quality Assessment

The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system was used to rate the quality of evidence.[12] According to the GRADE system, the quality of a body of evidence (a collection of studies) is categorized as very low, low, moderate, or high.[13] The quality of the evidence was rated using the GRADE profiler software developed by the GRADE group. The following 5 factors were considered for rating down the quality of evidence:

Study limitations: risk of bias was assessed within the component studies, and judgments of the overall quality of the body of evidence were made considering the extent to which a study contributed toward the estimate of the magnitude of effect.[14, 15] Methodological flaws, such as a

lack of concealed allocation, inadequate follow-up, and inadequate reporting of outcome measures, are considered for downgrading.

Indirectness of evidence: when there are substantial differences between the populations and interventions across studies and if studies used surrogate outcome measures.[16]

Imprecision: minimal or no overlap of the confidence interval (CI) across studies and a review not meeting the optimum information size criterion.[17] Using results from previous studies of PFMT for incontinence following prostatectomy, the sample size required for an adequately powered trial was calculated. If the total number of participants included in this review was smaller than the number of participants required for an adequately powered trial, the quality was rated down for imprecision.

Inconsistency of results across studies: if there was evidence of clinical or methodological heterogeneity as indicated by a large I-squared value (> 50%).[18]

Publication bias: studies were downgraded if they were industry sponsored or likely to be industry sponsored or if the authors shared another conflict of interest.[19] A funnel plot was planned if there were more than ten studies in the meta-analyses.

The GRADE approach specifically assesses risk of bias, indirectness, and publication bias in individual studies comprising the body of evidence; imprecision and inconsistency are applied

across studies.[14, 15] Assessment of GRADE quality for a single study was done by applying criteria, risk of bias, indirectness, and publication bias.[15]

Data Synthesis and Analysis

Meta-analysis was conducted using Review Manager 5.3 software.[20] Studies of similar interventions (PFMT alone; PFMT in conjunction with ES, BFB, or both), comparison groups (no treatment; sham; placebo), and time points (immediately following intervention; last follow-up) were grouped together for pooling. Postintervention data were used to obtain the pooled estimate of the difference between groups. For continuous data, the size of treatment effect and its 95% CI were estimated. For dichotomous data, the size of the treatment effect as the risk ratio (RR), along with the 95% CI were estimated. To obtain pooled estimates of the difference between groups, weighted mean differences were calculated. A chi-square test was used to determine heterogeneity. A fixed-effects model was used for minimal heterogeneity ($I^2 < 50\%$); otherwise, a random-effects model was used.[21] A *P* value of $\leq .05$ was considered to indicate statistical significance.

Results

A flow diagram of the study selection process based on a PRISMA approach is presented in Figure 1. Sixty-eight studies were eligible for full-text screening, of which only 15 were included in this systematic review (list of included and excluded studies is provided in supplementary material (eAppendix). One study reported results of 2 trials,[22] hence, data from 16 studies were included for the meta-analysis. Study characteristics of each included study are presented in Table 1. A summary of findings table from the GRADE profiler is presented in Table 2.

Study Characteristics

Fifteen included studies contributed data of 3503 participants aged 45 to 90. All included studies were prospective, mainly conducted in the American and European populations. The sample sizes in this review ranged from 16 to 203. The sample sizes in the included studies ranged from 16 to 203 men. Of the 15 included studies, participants had received radical prostatectomy in 13 studies and TURP in 1 study; the type of surgery was not reported in 1 study.[23] Interventions in the included studies are PFMT alone (6 studies), PFMT combined with ES (3 studies), PFMT combined with BFB (5 studies), and PFMT combined with ES and BFB (1 study). Of the 15 included studies, 8 studies reported information on who provided PFMT for the study participants. PFMT was taught by trained physical therapists in 6 studies,[22,24-28] a urologist in 1 study,[29] a research assistant in 1 study,[30] and a BFB technician with experience in PFMT in 1 study.[31] Of the 15 included studies, 3 studies reported the method of PFMT. Two[22, 26] of these 3 studies instructed men to visualize their penis moving inward and testicles upward with correct contraction of the PFMs in addition to anal squeezes; and 1 study[27] instructed men to contract PFMs by visualizing the movement of their penis **and testicles and avoiding anal squeeze.** Comparators included no treatment in 13 studies. Of these 13 studies, control groups in 7 studies received no treatment; verbal instructions and no formal PFMT in 5 studies; and lifestyle advice leaflet with no information about pelvic floor exercises in the leaflet in 1 study.[22] A sham ES was used as a comparator in 2 studies.[32,33]

GRADE Quality of Evidence

GRADE assessment of study limitations revealed that 8 of 15 studies concealed allocation. Four studies[25,28,29,33] had masked assessors, and 1 study had masked participants.[33] There was an inadequate follow-up of participants in 1 study.[34] For judging imprecision based on optimum information size, using data from a recent study[25] the sample size for an adequately powered 2-group trial was calculated to be 378, assuming an α of .05 and 80% power (β = .02). Because the number of participants included for meta-analysis is higher than the sample size for an adequately powered trial, none of the included studies were downgraded for imprecision based on the optimum information size criterion.

Effects of Intervention

PFMT versus no-treatment control. Meta-analysis of 3 studies of low GRADE quality[24,29,35] with 469 participants revealed a significantly larger number of continent men in the PFMT group than in the no-treatment control group immediately following intervention (RR = 2.21 [95% CI = 1.32 to 3.71]; *P* = .003) (Fig. 2A). Meta-analyses of 5 studies of moderate GRADE quality [22,24,29,35] (including a study by Glazener et al in 2011 reporting results of 2 randomized trials[22]) providing data on 1255 participants revealed a significantly larger number of continent men in the PFMT group than in the no-treatment control group at follow-up (RR = 1.17 [95% CI = 1.00 to 1.37]; *P* = .05) (Fig. 2B).

Meta-analyses of 2 studies of low GRADE quality[30,31] with 230 men found no statistically significant differences between groups receiving PFMT and no treatment (control) on grams of urine lost (1-hour pad test) either immediately following intervention (−9.17 [95% CI = −47.45

to 29.10]; *P* =.64) (Fig. 2C) or at follow-up (−6.08 [95% CI = −27.70 to 15.54]; *P* = .58) (Fig. 2D).

PFMT plus ES versus no-treatment control and sham ES. Meta-analyses of 2 studies of moderate GRADE quality[25,28] providing data of 129 men revealed significantly fewer grams of urine lost (24-hour pad test) in the PFMT combined with ES group than in the no-treatment control group immediately following intervention (−13.01 [95% CI = −21.63 to −4.38]; *P* = .003) (Fig. 2E). Data from 1 small study of moderate GRADE quality[33] with 56 participants found significantly fewer grams of urine lost on the 24-hour pad test in the PFMT plus ES group than in the sham ES group following intervention (−212.20 [95% CI = −374.54 to −49.86]; *P* = .01) but not at follow-up (−79.80 [95% CI = −180.58 to 20.98]; *P* = .12).

PFMT plus BFB versus no-treatment control. Meta-analyses of data of 374 men from 5 low to moderate GRADE quality studies[10, 26, 27, 34, 36] found a greater number of continent men in the intervention group than control group immediately after intervention (63/194 versus 38/180 in the control group); however, the effect was not statistically significant (RR = 1.70 [95% CI = 0.95 to 3.04]; *P* = .07) (Fig. 3A). Pooled analysis of the same 5 studies providing data of 345 men at follow-up also identified a greater number of continent men in the intervention group than the control group (131/178 vs 104/167 in the control group), but the effect was not statistically significant (RR = 1.17 [95% CI = 0.93 to 1.48]; *P* = .18) (Fig. 3B). Meta-analyses of 2[10,27] moderate GRADE quality studies found no statistically significant differences between groups on grams of urine lost on the 24-hour pad test either immediately following intervention

(−94.54 [95% CI = −433.38 to 244.30]; *P* = .58; n = 250) (Fig. 3C) or at follow-up (−9.29 [95% CI = −44.47 to 25.89]; *P* = .60; n = 221) (Fig. 3D).

PFMT plus BFB and ES versus sham ES. Data from 1 moderate GRADE quality study[32] with 102 men found a significantly greater number of continent men in the PFMT plus BFB and ES group than the sham ES group immediately following intervention (RR = 3.25 [95% CI = 1.62 to 6.51]; *P* = .0009) and at follow-up (RR = 1.22 [95% CI = 1.05 to 1.424]; *P* = .01).

Discussion

Principal Findings

The effectiveness of PFMT alone and in conjunction with ES, BFB, or both compared to the control for the management of postprostatectomy urinary incontinence was evaluated in this review. Four hundred thirty-four potentially relevant articles were identified in the searches. Of these, 15 studies providing data of 16 studies were included in the meta-analysis. Men who underwent radical prostatectomy or transurethral resection of the prostate were included in this review.

Interpretation of Results

Meta-analyses revealed a significantly larger number of continent men in the PFMT-alone group than in the no-treatment control group immediately following intervention and at follow-up. To accommodate for the substantial statistical and clinical heterogeneity (time points of assessment and intervention delivery and frequency), a random-effects model was chosen for the meta-analysis of follow-up data. Meta-analysis found that the relative probability of having urinary

incontinence is more likely (RR = 1.17) in the no-treatment control group compared with the PFMT group at 6 to 12 months' follow-up; however, the overall effect was of marginal significance (P = .05). It is worth noting that this result is derived from 5 studies of moderate GRADE quality providing data on 1255 participants.

Promising results supported by moderate GRADE quality of evidence were obtained at all assessment time points for PFMT combined with BFB and supplemented with ES compared to sham ES. However, this result was derived from a single study with 102 participants. Meta-analysis of 2 small studies that compared the effect of PFMT combined with ES to no treatment found significantly fewer grams of urine lost on the 24-hour pad test by a mean estimate of 13 g. Nevertheless, a pad weight of less than 8 g is an indicator of continence in a 24-hour pad test.[37] The mean estimate of 13 g and the 95% CI (21.6 to 4.3) around that estimate include a clinically trivial effect. Regardless, the safety of ES in the presence malignancy is still uncertain.[38] Application of ES directly over or even near tumor is contraindicated due to the danger of stimulation of proliferation of malignant cells and spread.[38-40] Current literature, however, lacks experimental evidence for the dissemination of cancer cells by electrical currents. In the absence of specific knowledge of the effects of ES on cancer cells, the current recommendation is that ES should be used only in palliative care.[38] Safety of ES in the presence of malignancy limits the clinical use of ES due to the risk of dissemination of postprostatectomy residual cancer cells .[38.41]

The specific effects of BFB are difficult to understand. All 4 meta-analyses of PFMT combined with BFB revealed no significant effect of the intervention when the control group received no treatment. Nonetheless, a greater number of men reported return of continence in the intervention group compared with the no-treatment control group immediately following the intervention (32% vs 21% in the control group; Fig. 3A) and at follow-up (74% vs 62% in the control group; Fig. 3B). It is worth noting that participants (n = 1190) were not masked to group allocation in any of the included studies that compared PFMT plus BFB with the no-treatment control. Knowledge of group assignment may have affected participants' responses which led to reporting bias.[42] Nonmasked participants are more likely to provide biased assessments of the effectiveness of the intervention than masked participants.[42] Further good-quality studies with active or sham/placebo control are required to confirm the effects of BFB before any definitive conclusions can be made. One[26] of the studies that provided data for pooled analyses of PFMT plus BFB reported that BFB was used to train PFMs, but study failed to report if BFB was provided for all participants. If some participants had not received BFB, it could have potentially influenced the results of that study. Future randomized trials must abide by the recommendations of the CONSORT statement in reporting.

Comparison of Results With Those of Previous Systematic Reviews

A meta-analysis common to the current review and the Cochrane review[3] by Anderson et al which evaluated the effectiveness of conservative therapies for postprostatectomy urinary incontinence is PFMT combined with BFB. Results obtained for PFMT combined with BFB versus the control in this review may not be compared with the results of the Cochrane review

because the latter review pooled together all studies of PFMT with and without BFB. However, the current review pooled studies of PFMT alone separately from PFMT combined with BFB.

The pooled effect obtained for PFMT combined with BFB compared to no treatment in this review is contradictory to the results obtained for this comparison in the systematic review by MacDonald et al.[4] This discrepancy in results may be due to the differences in inclusion criteria (preoperative PFMT was included in their review but not for the current review), the number of studies included in meta-analyses, and pooling of control groups. In the current review, we pooled no-treatment control studies separately from sham/placebo control studies, but MacDonald et al[4] pooled the no-treatment control together with the sham/placebo control, accounting for the difference in results.

Strengths and Weaknesses

A comprehensive and highly sensitive search strategy was used to identify RCTs evaluating the effectiveness of PFMT alone and in combination with ES, BFB, or both for postprostatectomy urinary incontinence in men. In order to prevent publication bias, we searched for abstract proceedings from various urological meetings and tried to identify full-text publications of those abstracts. Use of GRADE for rating the quality of evidence is another strength of this review. GRADE has been widely adopted in the assessment of health technology and guideline development organizations such as the World Health Organization, National Institute of Health and Care Excellence (United Kingdom), Agency for Healthcare Research and Quality (United States of America), and Cochrane Collaboration.[43] In addition, GRADE provides transparent and explicit judgments of the quality of evidence.[43] However, the GRADE system is not without its

difficulties: the criteria of precision (#3) and consistency (#4) could not be applied to the single study; however, the other 3 GRADE criteria were applied for quality evaluation. We could not run a funnel plot for assessment of publication bias as no more than 5 studies investigated each intervention, and at least 8 to 10 studies are required for running a funnel plot.[3,44,45] It is acknowledged, however, that assessment for publication bias was done using other methods recommended by GRADE; for example, grading down if there was industry influence or if the authors shared a conflict of interest. All studies included in the review are RCTs, but only half of the included studies concealed allocation. Although masking was not possible due to the nature of the intervention, only 4 of the included studies had masked assessors. The number of studies (only 2) included in meta-analyses for some comparisons was small.

Implications for Clinical Practice or Future Research

This review found low to moderate GRADE quality of evidence to suggest that PFMT alone could improve recovery of continence in men following prostatectomy. Meta-analysis revealed significant effects for PFMT alone compared to the control on the recovery of continence immediately following intervention and at follow-up. Considering the low expenses and minimal risks of PFMT, this intervention could be considered for clinical use. Data from 1 RCT of moderate to high GRADE quality suggests that PFMT combined with BFB and supplemented with ES compared to sham ES can significantly improve the recovery of continence in men following prostatectomy. Meta-analysis showed positive treatment effects for PFMT plus ES for postprostatectomy incontinence; however, its safety issues limit the clinical use of ES on men with prostate cancer due to the risk of dissemination of residual cancer cells. In the absence of literature relating to the safety of ES in the presence of malignancy, phase 4 studies (for

detecting uncommon adverse effects) with suitable models are required to test the safety of ES in malignancy. This systematic review also identified a moderate grade of evidence to support the use of PFMT combined with ES, although this result was derived from 2 small studies. The specific effects of PFMT combined with BFB is uncertain. Although meta-analysis found insignificant results for PFMT plus BFB, a greater number of men were continent in the intervention group compared with the no-treatment control group immediately following the intervention and at follow-up showing positive effects for this intervention. This result was obtained from studies that failed to mask participants and assessors to treatment groups. Methodological issues and lack of appropriate controls may have contributed to reporting bias. Well-designed controlled studies are required to clarify the role of PFMT plus BFB. Future high-quality studies with adequate masking (participants, therapist, and assessors) and active, sham or placebo have the potential to alter the effects obtained for PFMT combined with BFB in this review.

Author Contributions and Acknowledgments

Concept/idea/research design: P. Kannan, S.J. Winser, B. Fung, G. Cheing

Writing: P. Kannan, S.J. Winser, G. Cheing

Data collection: P. Kannan, S.J. Winser

Data analysis: P. Kannan, S.J. Winser

Consultation (including review of manuscript before submitting): P. Kannan, B. Fung, G. Cheing

The authors thank Ms Sweta Boghra and Ms Angel Chan for their assistance with the review.

Funding

No funding was obtained for this study.

Clinical Trial or Systematic Review Registration

This systematic review is registered in the PROSPERO registry (CRD42017065255).

Disclosures

The authors completed the ICJME Form for Disclosure of Potential Conflicts of Interest. They reported no conflicts of interest.

References

1. Torre LA, Siegel RL, Ward EM, Jemal A. Global cancer incidence and mortality rates and trends: an update. *Cancer Epidemiol Biomarkers Prev*. 2016;25:16–27.

2. Demidko YL, Glybochko PV, Vinarov AZ, et al. Treatment of urinary incontinence after radical prostatectomy using training of pelvic muscles under the control of biofeedback [in Russian]. *Urologiia*. 2015;Jan-Feb:41-43.

3. Anderson CA, Omar MI, Campbell SE, Hunter KF, Cody JD, Glazener CM. Conservative management for postprostatectomy urinary incontinence. *CochraneDatabase Syst Rev*. 2015;(1):CD001843.

4. MacDonald R, Fink HA, Huckabay C, Monga M, Wilt TJ. Pelvic floor muscle training to improve urinary incontinence after radical prostatectomy: a systematic review of effectiveness. *BJU Int*. 2007;100:76–81.

5. Hunskaar S, Arnold E, Burgio K, Diokno A, Herzog A, Mallett V. Epidemiology and natural history of urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct*. 2000;11:301–319.

6. Chughtai B, Lee R, Sandhu J, Te A, Kaplan S. Conservative treatment for postprostatectomy incontinence. *Rev Urol*. 2013;15:61.

7. Jezernik S, Craggs M, Grill WM, Creasey G, Rijkhoff NJ. Electrical stimulation for the treatment of bladder dysfunction: current status and future possibilities. *Neurol Res*. 2002;24:413–430.

8. Imamura M, Abrams P, Bain C, et al. Systematic review and economic modelling of the effectiveness and cost-effectiveness of non-surgical treatments for women with stress urinary incontinence. *Health Technol Assess*. 2010;14:1–188, iii–iv.

9. Dumoulin C, Hay-Smith J. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database Syst Rev*. 2010;(1):CD005654.

10. Ahmed MT, Mohammed AH, Amansour A. Effect of pelvic floor electrical stimulation and biofeedback on the recovery of urinary continence after radical prostatectomy. *Turkiye Fiziksel Tip ve Rehabilitasyon Dergisi*. 2012;58:170-176.

11. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Ann Intern Med*. 2009;151:W65–W94.

12. Guyatt G, Oxman AD, Akl EA, et al. GRADE guidelines: 1. Introduction—GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol*. 2011;64:383–394.

13. Guyatt G, Oxman A, Vist G, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336:924–926.

14. Balshem H, Helfand M, Schünemann HJ, et al. GRADE guidelines: 3. Rating the quality of evidence. *J Clin Epidemiol*. 2011;64:401-406.

15. Guyatt GH, Oxman AD, Vist G, et al. GRADE guidelines: 4. Rating the quality of evidence—study limitations (risk of bias). *J Clin Epidemiol*. 2011;64:407–415.

16. Guyatt GH, Oxman AD, Kunz R, et al. GRADE guidelines: 8. Rating the quality of evidence—indirectness. *J Clin Epidemiol*. 2011;64:1303–1310.

17. Guyatt GH, Oxman AD, Kunz R, et al. GRADE guidelines: 6. Rating the quality of evidence—imprecision. *J Clin Epidemiol*. 2011;64:1283–1293.

18. Guyatt GH, Oxman AD, Kunz R, et al. GRADE guidelines: 7. Rating the quality of evidence—inconsistency. *J Clin Epidemiol*. 2011;64:1294–1302.

19. Guyatt GH, Oxman AD, Montori V, et al. GRADE guidelines: 5. Rating the quality of evidence—publication bias. *J Clin Epidemiol*. 2011;64:1277–1282.

20. Review Manager (RevMan) [computer program]. Version 5.3. Copenhagen, Denmark: The Nordic Cochrane Centre, The Cochrane Collaboration; 2014.

21. Borenstein M, Hedges LV, Higgins J, Rothstein HR. *A Basic Introduction to Fixed-Effect and Random-Effects Models for Meta-Analysis.* Chichester, United Kingdom: John Wiley & Sons, Ltd; 2009:97–111.

22. Glazener C, Boachie C, Buckley B, et al. Urinary incontinence in men after formal one-to-one pelvic-floor muscle training following radical prostatectomy or transurethral resection of the prostate (MAPS): two parallel randomised controlled trials. *Lancet*. 2011;378:328–337.

23. Zhang AY, Strauss GJ, Siminoff LA. Intervention of urinary incontinence and quality of life outcome in prostate cancer patients. *J Psychosoc Oncol*. 2006;24:17–30.

24. Overgard M, Angelsen A, Lydersen S, Morkved S. Does physiotherapist-guided pelvic floor muscle training reduce urinary incontinence after radical prostatectomy? A randomised controlled trial. *Eur Urol*. 2008;54:438–448.

25. Gomes CS, Pedriali FR, Urbano MR, Moreira EH, Averbeck MA, Almeida SHM. The effects of Pilates method on pelvic floor muscle strength in patients with post-prostatectomy urinary incontinence: a randomized clinical trial. *Neurourol Urodyn*. 2018;37:346–353.

26. Parekh A, Feng M, Kirages D, Bremner H, Kaswick J, Aboseif S. The role of pelvic floor exercises on post-prostatectomy incontinence. *J Urol*. 2003;170:130–133.

27. Moore KN, Valiquette L, Chetner MP, Byrniak S, Herbison GP. Return to continence after radical retropubic prostatectomy: a randomized trial of verbal and written instructions versus therapist-directed pelvic floor muscle therapy. *Urology*. 2008;72:1280–1286.

28. Pedriali FR, Gomes CS, Soares L, et al. Is Pilates as effective as conventional pelvic floor muscle exercises in the conservative treatment of post-prostatectomy urinary incontinence? A randomised controlled trial. *Neurourol Urodyn*. 2016;35:615–621.

29. Manassero F, Traversi C, Ales V, et al. Contribution of early intensive prolonged pelvic floor exercises on urinary continence recovery after bladder neck-sparing radical prostatectomy: results of a prospective controlled randomized trial. *Neurourol Urodyn*. 2007;26:985–989.

30. Lin YH, Yang MS, Chia-Hsiang Lin V, Yu TJ, Chiang PH. The effectiveness of pelvic floor exercise on urinary incontinence in radical prostatectomy patients. *Int J Urol Nurs*. 2011;5:115–122.

31. Zhang AY, Bodner DR, Fu AZ, et al. Effects of patient centered interventions on persistent urinary incontinence after prostate cancer treatment: a randomized, controlled trial. *J Urol*. 2015;194:1675–1681.

32. Van Kampen M, De Weerdt W, Van Poppel H, De Ridder D, Feys H, Baert L. Effect of pelvic-floor re-education on duration and degree of incontinence after radical prostatectomy: a randomised controlled trial. *Lancet*. 2000;355:98–102.

33. Yamanishi T, Mizuno T, Watanabe M, Honda M, Yoshida K. Randomized, placebo controlled study of electrical stimulation with pelvic floor muscle training for severe urinary incontinence after radical prostatectomy. *J Urol*. 2010;184:2007–2012.

34. Ribeiro LH, Prota C, Gomes CM, et al. Long-term effect of early postoperative pelvic floor biofeedback on continence in men undergoing radical prostatectomy: a prospective, randomized, controlled trial. *J Urol*. 2010;184:1034–1039.

35. Filocamo MT, Li Marzi V, Del Popolo G, et al. Effectiveness of early pelvic floor rehabilitation treatment for post-prostatectomy incontinence. *Eur Urol*. 2005;48:734–738.

36. Tienforti D, Sacco E, Marangi F, et al. Efficacy of an assisted low-intensity programme of perioperative pelvic floor muscle training in improving the recovery of continence after radical prostatectomy: a randomized controlled trial. *BJU Int*. 2012;110:1004–1010.

37. Ghoniem G, Stanford E, Kenton K, et al. Evaluation and outcome measures in the treatment of female urinary stress incontinence: International Urogynecological Association (IUGA) guidelines for research and clinical practice. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19:5–33.

38. Laakso E-L, Young C. Electrophysical agents (EPAs) for symptom control in cancer care–what is the evidence? *Phys Ther Res*. 2010;15:334-43.

39. Robertson VJ. Guidelines for the clinical use of electrophysical agents 2001. St Kilda Central, Victoria, Australia: Australian Physiotherapy Association; 2001.

40. Bazin S, Kitchin S, Maskill D, Reed A, Skinner A, Walsh D. Guidance for the clinical use of electrophysical Agents. London: *Chartered Society of Physiotherapy*. 2006.

41. Ruppender NS, Morrissey C, Lange PH, Vessella RL. Dormancy in solid tumors: implications for prostate cancer. *Cancer and Metastasis Rev*. 2013;32(3-4):501-9.

42. Karanicolas PJ, Farrokhyar F, Bhandari M. Blinding: who, what, when, why, how? *Can J Surg*. 2010;53:345.

43. Meader N, King K, Llewellyn A, et al. A checklist designed to aid consistency and reproducibility of GRADE assessments: development and pilot validation. *Syst Rev*. 2014;3:82

44. Marius Goldkuhle VMN, Weigl A, Dahm P, Skoetz N. A systematic assessment of Cochrane reviews and systematic reviews published in high-impact medical journals related to cancer. *BMJ Open*. 2017;8:e020869.

45. Sterne JA, Sutton AJ, Ioannidis JP, et al. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. *BMJ*. 2011;343:d4002.

.

Table 1.

Summary of Included Studies[a]

Study	Country of Publication	Type of Surgery	Age of Participants (y)	Sample Size	Intervention	Outcome Measure(s)	Results	
							Time	Mean (SD)
Gomes et al,[25] 2018	Brazil	RP	50–75	N = 104 Exp: n = 35 Con: n = 35	Exp: PFMT combined with ES Con: no treatment	24-h pad test	10 wk	Exp: 67.4 (131.9) Con: 72.9 (97.3)
Pedriali et al,[27] 2016	Brazil	RP	50–75	N = 85 Exp: n = 28 Con: n = 31	Exp: PFMT combined with ES Con: no treatment	24-h pad test	4 mo	Exp: 67.1 (12.7) Con: 80.3 (20.9)
Zhang et al,[32] 2015	United States	Not reported	64–67	N = 244 Exp: n = 81 Con: n = 82	Exp: PFMT combined with BFB plus telephone Con: no treatment	1-h pad test	3 mo	Exp: 17.9 (43.3) Con: 11 (24.2)
							6 mo	Exp: 18.1 (49.2) Con: 13.8 (36.7)
Manassero et al,[26] 2007	Italy	RRP	67.3 (mean) (range not reported)	N = 94 Exp: n = 54 Con: n = 40	Exp: PFMT Con: no treatment	No. of continent men	3 mo	Exp: 9 Con: 1
							6 mo	Exp: 45 Con: 19
Ahmed et al,[10] 2012	Egypt	RP	57.4 (mean) (range not reported)	N = 80 Exp: n = 28 Con: n = 26	Exp: PFMT combined with ES plus BFB Con: no treatment	24-h pad test and no. of continent men	6 wk (24-h pad test)	Exp: 263 (145.9) Con: 533 (316.5)
							6 mo (24-h pad test)	Exp: 36 (95.9) Con: 123 (116.5)
							6 wk (no. of continent men)	Exp: 10 Con: 5
							6 mo (no. of continent men)	Exp: 27 Con: 17

Tienforti et al,[35] 2012	Italy	RP	52–74	N = 32 Exp: n = 16 Con: n = 16	Exp: PFMT combined with BFB Con: no treatment	No. of continent men	1 mo	Exp: 6 Con: 0
							6 mo	Exp: 10 Con: 1
Glazener et al,[21] 2011 (trial 1)	United Kingdom	RP	47–76	N = 391 Exp: n = 196 Con: n = 195	Exp: PFMT Con: no treatment	No. of continent men	12 mo	Exp: 48 Con: 44
Glazener et al,[21] 2011 (trial 2)	United Kingdom	TURP	47–90	N = 397 Exp: n = 194 Con: n = 203	Exp: PFMT Con: no treatment	No. of continent men	12 mo	Exp: 68 Con: 78
Lin et al,[31] 2011	Taiwan	RP	47–79	N = 67 Exp: n = 39 Con: n = 28	Exp: PFMT Con: no treatment	1-h pad test	1 mo	Exp: 76.7 (53.0) Con: 109.6 (85.8)
							3 mo	Exp: 9.3 (25.2) Con: 27.1 (40.9)
Ribeiro et al,[28] 2010	Brazil	RP	64 (mean) (range not reported)	N = 54 Exp: n = 26 Con: n = 28	Exp: PFMT combined with BFB Con: no treatment	No. of continent men	1 mo	Exp: 20 Con: 9
							12 mo	Exp: 26 Con: 23
Yamanishi et al,[24] 2010	Japan	RRP	50–76	N = 56 Exp: n = 26 Con: n = 30	Exp: PFMT combined with ES Con: sham ES	24-h pad test	1 mo	Exp: 210.4 (261.2) Con: 422.6 (356.5)
							12 mo	Exp: 18.0 (49.3) Con: 97.8 (276.6)
Moore et al,[33] 2008	Canada	RRP	Not reported	N = 166 Exp: n = 105 (1 mo); n = 89 (12 mo) Con: n = 91 (1 mo); n = 78 (12 mo)	Exp: PFMT combined with BFB Con: no treatment	24-h pad test and no. of continent men	1 mo (24-h pad test)	Exp: 318.0 (417.4) Con: 242.2 (328.2)
							12 mo (24-h pad test)	Exp: 46.5 (214.6) Con: 8.4 (9.7)

							2 mo (no. of continent men)	Exp: 20 Con: 20
							12 mo (no. of continent men)	Exp: 53 Con: 47
Overgard et al,[30] 2008	Norway	RP	48–72	N = 80 Exp: n = 31 (6 wk); n = 36 (12 mo) Con: n = 35 (6 wk); n = 39 (12 mo)	Exp: PFMT by physical therapist Con: no treatment	No. of continent men	6 wk	Exp: 5 Con: 6
							12 mo	Exp: 33 Con: 28
Filocamo et al,[29] 2005	Italy	RRP	45–75	N = 300 Exp: n = 150 (1 mo); n = 150 (6 mo) Con: n =150 (1 mo); n = 148 (6 mo)	Exp: PFMT Con: no treatment	No. of continent men	1 mo	Exp: 29 Con: 12
							6 mo	Exp: 148 Con: 130
Van Kampen et al,[23] 2000	Belgium	RRP	52–76	N = 102 Exp: n = 50 Con: n = 52	Exp: PFMT combined with BFB and ES Con: sham ES	No. of continent men	1 mo	Exp: 25 Con: 8
							12 mo	Exp: 48 Con: 41
Parekh et al,[34] 2003	United States	RP	58.55 (mean) (range not reported)	N = 38 Exp: n = 19 Con: n = 19	Exp: PFMT combined with BFB Con: no treatment	No. of continent men	6 wk	Exp: 7 Con: 4
							13 mo	Exp: 15 Con: 16

[a]BFB = biofeedback; ES = electrical stimulation; N = total sample size; n = sample size of group; PFMT = pelvic floor muscle training; RP = radical prostatectomy; RRP = radical retropubic prostectomy; TURP = transurethral resection of tumor.

Table 2.

Summary of Findings for Men With Urinary Incontinence After Prostatectomy (GRADE)[a]

PFMT Compared to No Treatment					
Outcome and time point of measurement	**Illustrative comparative risks[b] (95% CI)**		**Relative effect (95% CI)**	**No of Participants (studies)**	**Quality of the evidence (GRADE)[c]**
	Assumed risk	Corresponding risk			
	No treatment	PFMT			
Number of continent men: Immediately following intervention	Study population		RR 2.21 (1.32 to 3.71)	469 (3 studies)	⊕⊕⊖⊖ Low[d,e]
	83 per 1000	183 per 1000 (110 to 308)			
	Moderate risk				
	80 per 1000	177 per 1000 (106 to 297)			
Number of continent men: Follow-up	Study population		RR 1.17 (1 to 1.37)	1255 (5 studies)	⊕⊕⊕⊖[e] Moderate
	478 per 1000	560 per 1000 (478 to 655)			
	Moderate risk				
	475 per 1000	556 per 1000 (475 to 651)			
PFMT vs No Treatment: 1-hr Pad Test					
	No treatment	PFMT			
1-hr pad test: immediately following intervention		The mean 1-hr pad test immediate in the intervention groups was 9.17 lower (47.45 lower to 29.1 higher)		230 (2 studies)	⊕⊕⊖⊖ Low[e,f]
1-hr pad test: Follow-up		The mean 1-hr pad test immediate in the intervention groups was 6.08 lower (27.70 lower to 15.54 higher)		230 (2 studies)	⊕⊕⊖⊖ Low[e,f]
PFMT + ES vs No Treatment: 24-hr Pad Test					
	No treatment	PFMT plus ES			
24-hr pad test: Immediately following intervention		The mean 24-hr pad test in the intervention groups was 13.01 lower (21.63 to 4.38 lower)		129 (2 studies)	⊕⊕⊕⊖ Moderate[e]
PFMT + ES vs Sham-ES					

	Sham-ES	PFMT plus ES			
24-hr pad test: Immediately following intervention		The mean 24-hr pad test in the intervention groups was 212.2 lower (374.54 to 49.86 lower)		56 (1 study)	⊕⊕⊕⊖ Moderate[e,g]
24-hr pad test: Follow-up		The mean 24-hr pad test follow-up in the intervention groups was 79.8 lower (180.58 lower to 20.98 higher)		56 (1 study)	⊕⊕⊕⊖ Moderate[e,g]
PFMT + BFB Compared to No Treatment Control					
	No treatment control	PFMT plus BFB			
Number of continent men: Immediately following intervention	Study population		RR 1.7 (0.95 to 3.04)	374 (5 studies)	⊕⊕⊖⊖ Low[e,h]
	211 per 1000	359 per 1000 (201 to 642)			
	211 per 1000	359 per 1000 (200 to 641)			
Number of continent men: Follow-up	Study population		RR 1.17 (0.93 to 1.48)	345 (5 studies)	⊕⊕⊕⊖ Moderate[h]
	623 per 1000	729 per 1000 (579 to 922)			
	654 per 1000	765 per 1000 (608 to 968)			
PFMT + BFB vs No Treatment: 24-hr Pad Test					
Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	No treatment	PFMT plus BFB			
24-hr pad test: Immediately following intervention		The mean 24-hr pad test immediate in the intervention groups was 94.54 lower (433.38 lower to 244.3 higher)		250 (2 studies)	⊕⊕⊕⊖ Moderate[e]
24-hr pad test: Follow up		The mean 24-hr pad test follow up in the intervention groups was 9.29 lower (44.47 lower to 25.89 higher)		221 (2 studies)	⊕⊕⊕⊖ Moderate[e]
PFMT + ES and BFB Compared to Sham-ES					
	Sham-ES	PFMT plus ES and BFB			

Number of continent men: immediately following intervention	Study population		RR 3.25 (1.62 to 6.51)	102 (1 study)	⨁⨁⨁⊖ Moderate[e,g]
	154 per 1000	500 per 1000 (249 to 1000)			
	154 per 1000	500 per 1000 (249 to 1000)			
Number of continent men: Follow-up	Study population		RR 1.22 (1.05 to 1.42)	102 (1 study)	⨁⨁⨁⊖ Moderate[e,g]
	788 per 1000	962 per 1000 (828 to 1000)			
	789 per 1000	963 per 1000 (828 to 1000)			

[a]BFB = biofeedback; ES = electrical stimulation; GRADE = Grading of Recommendations, Assessment, Development, and Evaluation; PFMT = pelvic floor muscle training; RR = risk ratio.

[b]The basis for the assumed risk (e.g. the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

[c]GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

[d]Allocation not concealed in three studies[26,29,30]

[e]Wide CI

[f]Allocation not concealed in two studies[31,32]

[g]No applicable (single study)

[h]Allocation not concealed in three studies[28,34,35]

Figure 1.

Flow of studies through the review.

Figure 2.

Pelvic floor muscle training (PFMT) versus no treatment. (A) Number of continent men immediately following intervention. (B) Number of continent men at follow-up. (C) 1-h pad test immediately following intervention. (D) 1-h pad test at follow-up. (E) 24-h pad test immediately following intervention. ES = electrical stimulation; IV = inverse-variance; M-H = Mantel-Haenszel.

Figure 3.

Pelvic floor muscle training (PFMT) plus biofeedback (BFB) versus no-treatment control. (A) Number of continent men immediately following intervention. (B) Number of continent men at follow-up. (C) 24-h pad test immediately following intervention. (D) 24-h pad test at follow-up. IV = inverse-variance; M-H = Mantel-Haenszel.

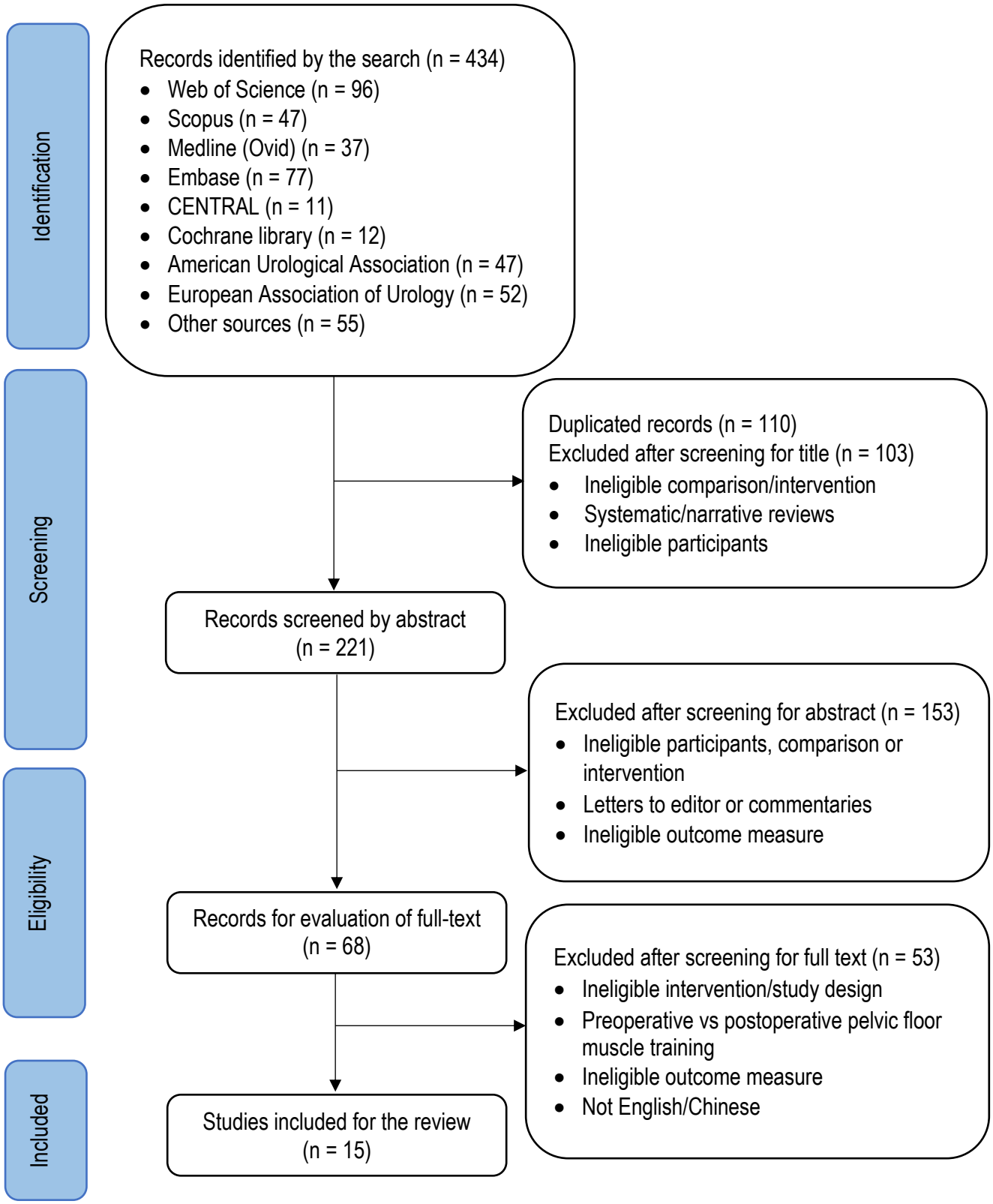
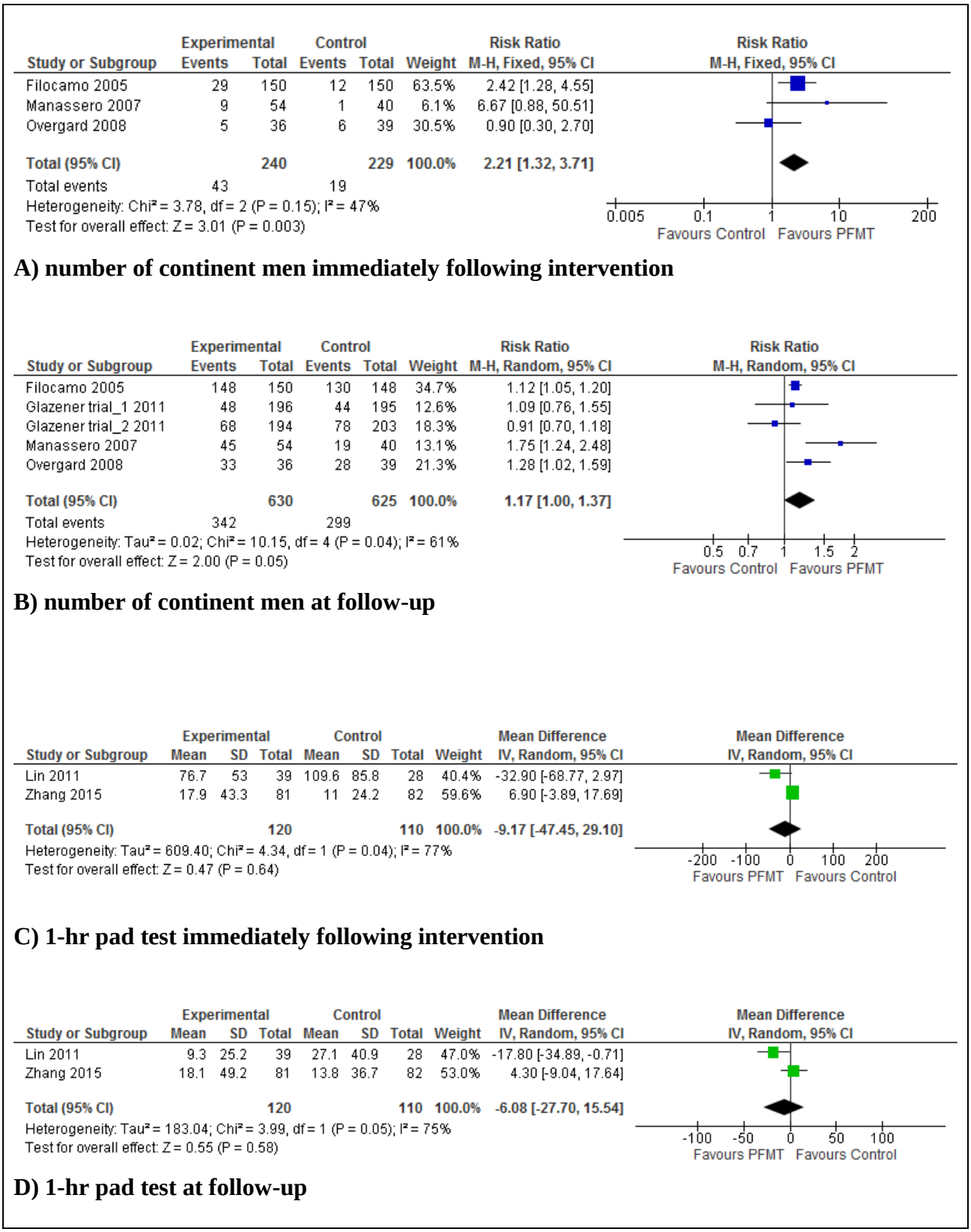
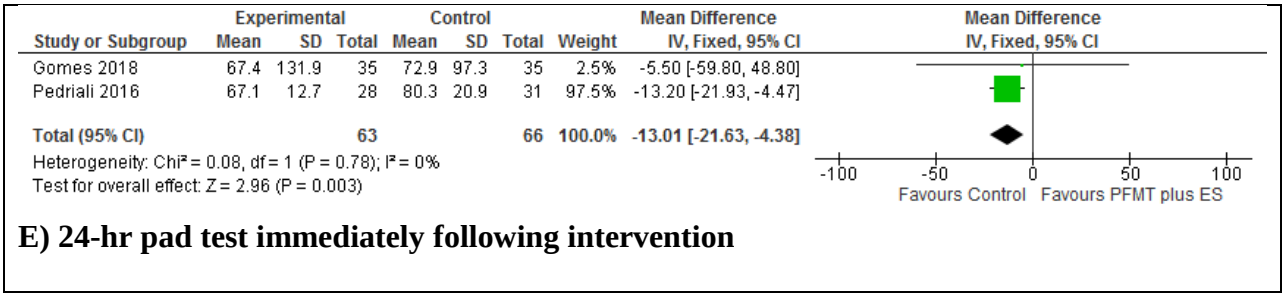

Identification
Screening
Eligibility
Included
Records identified by the search (n = 434)
Web of Science (n = 96)
Scopus (n = 47)
Medline (Ovid) (n = 37)
Embase (n = 77)
CENTRAL (n = 11)
Cochrane library (n = 12)
American Urological Association (n = 47)
European Association of Urology (n = 52)
Other sources (n = 55)
Duplicated records (n = 110)
Excluded after screening for title (n = 103)
Ineligible comparison/intervention
Systematic/narrative reviews
Ineligible participants
Records screened by abstract (n = 221)
Excluded after screening for abstract (n = 153)
Ineligible participants, comparison or intervention
Letters to editor or commentaries
Ineligible outcome measure
Records for evaluation of full-text (n = 68)
Excluded after screening for full text (n = 53)
Ineligible intervention/study design
Preoperative vs postoperative pelvic floor muscle training
Ineligible outcome measure
Not English/Chinese
Studies included for the review (n = 15)

Figure 2: Pelvic floor muscle training vs no treatment

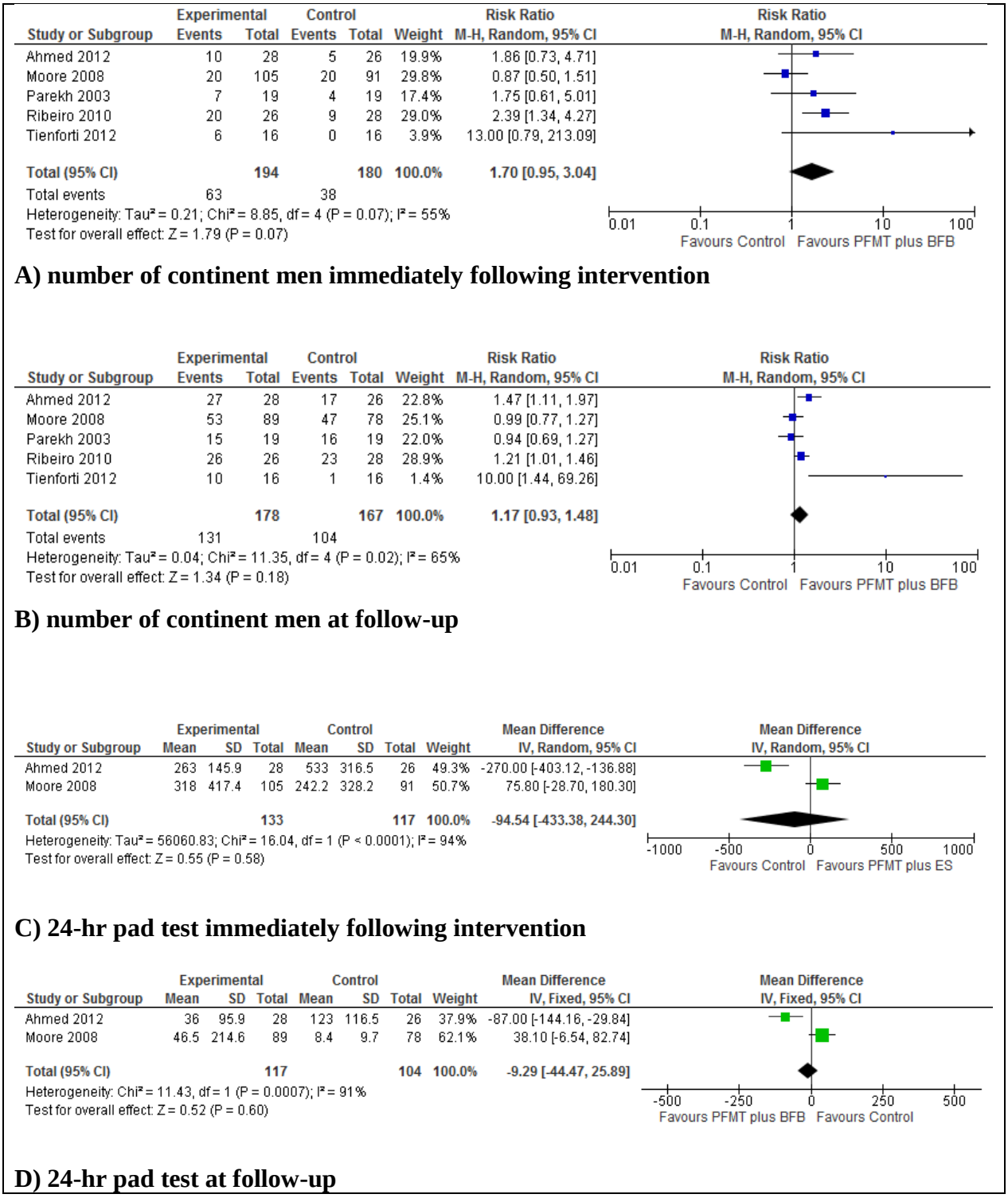




E) 24-hr pad test immediately following intervention

Abbreviations: ES: Electrical Stimulation; IV: Inverse-Variance; M-H: Mantel-Haenszel; PFMT: Pelvic Floor Muscle Training.

Figure 3: Pelvic floor muscle training plus biofeedback vs no treatment control



Abbreviations: BFB: Biofeedback; ES: Electrical Stimulation; IV: Inverse-Variance; M-H: Mantel-Haenszel; PFMT: Pelvic Floor Muscle Training.